# Filtration and Beam Restriction

| Question | Answer |
|---|---|
| Ability to image small objects that have high subject contrast. | Spatial Resolution |
| Ability to distinguish between two similar tissues | Contrast Resolution |
| Image detail or visibility of detail | the sharpness of small structures |
| What are two principle ways of controling scatter radiation that reaches the IR? | grids and beam restricting devices |
| What 3 factors influence the intensity of scatter reaching the IR? | kVp, field size, patient thickness |
| What are three types of beam restricting devices? | aperture diaphragm, cones and cylinders, variable aperture diaphragm (PBL) |
| Explain why kVp can have such an influence on the intensity of scatter reaching the IR? | Increased kVp will allow for more penetration of beam and there will be lower patient dose (due to less attenuation) but an increase in scatter and decrease in image contrast |
| By decreasing the field size you _____ the level of scatter radiation. | reduce |
| What is the simplest type of beam restricting device that is attached to the head of x ray tube? | aperture diaphragm |
| Cones and cylinders | restrict beam to a required size; modifications of aperture diaphragms |
| Also known as the variable aperture collimator; it is most common in diagnostic radiography | PBL - positive beam limitation (automatic collimation) |
| What is the main purpose of beam restriction? | reduce scatter to improve contrast and reduce patient dose |
| If collimation is increase, what will happen to pt. dose, density and contrast? | decrease pt. dose, decreased density, increased contrast with proper compensation for density loss |
| If field size is increased (open up collimator), what will happen to pt. dose, scatter, density and contrast? | increased patient dose, increased scatter, increased density and decreased scatter |
| What is the biggest problem with using lead aperture diaphragms? | Problem with ghosting (shadow of anatomy) |
| Ghosting is due to what? | off focus radiation (stem radiation) - electrons radiation does not hit target correctly |
| Where is the lead aperture diaphragm located? | Between the anode and the patient |
| What type of test can be performed to see your collimators accuracy? | 8-9 penny test; checks for collimator cutoff |
| Entrance shutters | immovable circular piece of lead mounted below focal spot; purpose is to absorb any off focus or stem radiation |
| What is the purpose of the mirror in the PBL? | project light image onto patient; sits at a 45 degree angle and sits exactly between the light source and focal spot siz |
| Moveable lead shutters | controlled by tech; helps to reduce the beam |

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|---|---|
| Main purpose of Filters. | Harden the beam to reduce patient skin exposure |
| Filters have an affect on scatter. T/F | False - they have nothing to do with scatter |
| What type of material do we use in filters? | aluminum or can be a combination of aluminum and copper |
| How do filters reduce patient dose? | absorbs low energy, long wavelength radiation that contributes to skin dose and leaves higher nergy, short wavelength beam which has more penetration. |
| Where is the filter located? | between the sourece and patient at collimator housing |
| Measurement of the amount of absorber required to reduce intial beam intesnity by 1/2 or 50%. | Half value layer |
| What is total AL filtration? | inherent plus added AL layer |
| In total filtration what makes up the inherrent or built in element? | envelope (gas or metal; houses anode and cathode) and oil |
| What are the requirements for the mm AL used if the kVp range was less than 50? | .5 required |
| What are the requirements for the mm AL used if the kVp range was 50-70? | 1.5 required |
| What are the requirements for the mm AL used if the kVp range was 70-100? | 2.5 required; 3.0 recommened |
| What are the requirements for the mm AL used if the kVp range was greater than 100? | 3.0 required |
| What affect do filters have on image quality (contrast and density)? | density - decreases density as eliminates quantity of beam usedcontrast - lower contrast as leaves with higher kVp |
| What are two examples of compensating filters? | wedge filter and trough filter |
| What is the purpose of the compensating filters? | Even out density of body parts with unequal thickness |
| When radiating a foot how would you use the wedge filter? | the thickest part of filter would be placed under the thinnest part |

# Grids

| Question | Answer |
|---|---|
| What causes scatter? | kVp, field size, patient thickness |
| what are some ways to reduce scatter? | grid, beam restricting devices |
| Extremely effective in reducing the amount of scatter reaching the IR | grid |
| Grids are made of _____. | Alternating radiopaque material (lead- grid strips) and radiolucent material (aluminum or plastic - interspace material. |
| what is the purpose of the interspace material? | to maintain a precise separation between the delicate lead strips of the grid. |
| What is the purpose of the grid strips? | absorbs scatter |
| Encases the grid completely by a thin cover of aluminum and provides rigidity and helps seal out moisture. | Grid casing |
| Grids are designed to transmit x rays whose direction is a _____ ____ from source to IR. | straight line |
| High quality grids can clean up how much scatter? | 80-90% of scatter |
| Grid Ratio | height of the grid divided by the interspace width |
| what is the formula for grid ratio? | Grid Ratio= H/D |
| what are the three most important dimensions on a grid? | T = the thickness of the grid stripD= the width of the interspace materialH = the height of the grid |
| what is contrast? | density differences |
| Higher ratio grids are not as effective as low ratio grids in cleaning up of scatter. T/F | False - Higher ratio grids are better at cleaning up scatter due to the angle of deviation being smaller |
| Do you use more or less dose with higher ratio grids? | more dose |
| The number of grid strips or grid lines per ich or centimeter | Grid Frequency |
| If a grid has a high frequency will it show more or less grid lines? | less grid lines |
| With increased frequency do you get more or less dose to patient? Do you have to use more or less technique? | more dosemore technique |
| what is the range of grid frequencies | 25-45 lines per centimeter (60-110 lines per inch) |
| What is the formula for grid frequency? | grid frequency= 10,000 um/cm /(T+D) um/line pair |
| What is the purpose of the interspace material? | To maintain a precise separation between the delicate lead strips of the grid. |
| What two materials can the interspace be made of? | aluminum or plastic |
| What material is mostly used for the grid strips? | lead |
| What is the principle function of grids? | To improve image contrast |
| Name 3 factors that affect grid performance. | Contrast Improvement FactorBucky FactorSelectivity |
| What is the contrast improvement factor? | it detects the ability of the grid to improve radiographic contrast |

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|---|---|
| what is the formula for the contrast improvement factor (k)? | k= radiographic contrast with grid / radiographic contrast without a grid |
| what is the k range? | 1.5-2.5 (radiographic contrast is doubled when grids are used; a k of 1 indicates no improvement) |
| Is the k higher for higher ratio grids? | yes |
| Increase of technique to produce the same optical density. Attempt to measure the penetration of both primary and scatter radiation through the grid. | Bucky factor |
| what is the formula for Bucky factor? | incident remnan radiation/ transmitted image - forming radiation = patient dose with grid/ patient dose without grid |
| The higher the grid ratio the _____the bucky factor. | higher |
| A increase in _____ will _____ the bucky factor. | kVp, increase |
| With an increase with bucky factor what will hapen to patient dose? | increase |
| Ratio of transmitted primary radiation and transmitted scatter radiation. | Selectivity |
| What is the formula for Selectivity? | Greek sigma = primary radiation transmitted through grid/ scatter radiation tansmitted through grid |
| The more lead a grid has the _____the selectivity and more efficient it is at cleaning up _____. | higher, scatter |
| What are some types of grids? | Parallel (linear), Crossed, Focused, Moving |
| Parallel (linear) grid | simplest; all lead grid strips are parallel; clean up scatter radiation in only one direction |
| Undesirable absorption of primary x rays by the grid. | Grid cutoff |
| With Linear grids if you do not use the proper _____ you will get grid cutoff. | SID (source to image receptor distance) |
| Lead grid strips running parallel to both the long and short axes of the grid | Crossed grid |
| What are two disadvantages of using cross grids? | Must position correctly so the x ray beam coincides with the center of the grid and if table and tube are not aligned properly you will get grid cutoff |
| Which grid is designed to minimize grid cutoff? | Focused grids |
| How do the focused grid lead strips lie? | They coincide with the divergence of the beam. |
| It is okay to use a focused grid at any desirable SID. True/False | False - all focused grids are marked with intended focal distance. It must be used at the specified SID. |
| What are grid lines? | They are images made when primary x rays are absorbed in the grid strips. |
| Moving grids | movement of the grid while the x-ray exposure is being made. the grid lines disappear and less increase of technique. |
| What is another name for the moving grids? | Potter-bucky diaphragm (named after Hollis E. Potter who developed this idea in 1920) |
| _____ are usually used as moving grids. | Focused grids |
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|---|---|
| What are the two types of moving grids? | oscillating and reciprocating |
| Oscillating grids | positioned in a frame , a powerful electromagnet pulls the grid to one side and releases it at the beginning of the exposure, and oscillates in a circular fashion |
| Reciprocating grids | moving grid that is motor driven back and forth several times during exposure |
| What are some disadvantages to moving grids? | - requires a bulky mechanism - distance between patient and IR is increased due to mechanisms increase in magnification and image blur-exposure time is longer |
| What are four types of problems that can occur with focused grids? | off-level, off-centered, off-focus, upside-down |
| Off-level grid | caused by angle of tube or central ray; cuts across or perpendicular to grid lines; cutoffon entire image; most common |
| Off-center grid | cutoff on one side than the other due to central ray not centered on grid |
| off-focused grid | not using with proper SID; only occurs with focused grids; cutoff on periphery but not at severe as focused grid upside down (use a parallel grid if have no control over SID) |
| Upside down grid | least common;a radiographic image is taken with an upside down focused grid shows sever grid cutoff on either side of the central ray |
| What are some common grid ratios used? | 5:1, 6:1, 8:1, 10:1-12:1, 16:1 |
| What are some disadvantages to using a grid? | Increase in patient dose and increased technique |
| What technique can we use in place of grids? | Air gap technique |
| What is the air gap technique? | IR is moved 10-15 cm from pt. Portion of x rays are scattered away from IR contrast (mAs is increased approx. 10% for every cm of air gap) |
| what are some disadvantages of the air gap technique? | increased dose for pt. and image magnification with associated focal spot blur |
| In the air gap technique does air act as a filter? | No, it does not act as a filter. The scattered x rays diverge from the IR due to the distance between the patient and IR. |
| For diagnostic kVp range the highest quantity is at _____ to patient. (backscatter) | 180 degrees |
| For the Diagnostidc level, the highest intensity or stregngth of scatter is at _____ to patient. (occupational exposure) | 90 degrees |
| In the chest, what percentage of the useful density is due to scatter? Abdoment? | 50%; 90% |
| When do we use a grid? | when the part is greater than 10-12 cm thick and the kVp is greater than 60 |
| What is the moire effect? | It is a zebra pattern that shows when you use tooo low a frequency grid with electronic imaging or a grid is put into a bucky |
| what is grid cutoff? | undesirable absorption of primary x rays by the grid |
| Focused grids | lead lines lie on the imaginary radial lines of a circle centered at the focal spot so they coincide with divergence of x ray beam |

# High/Low contrast

| Question | Answer |
|---|---|
| If you have high kVp (> 60 kVp) what will happen to the following factors? | Look at the following factors |
| energy | high |
| frequency | high |
| wavelength | short |
| attenuation | low |
| beam quality | high (more penetration) |
| Scatter production | high |
| B&W or gray | gray |
| image contrast | low |
| scale contrast | long scale |
| If you have low kVp (< 60 kVp) what will happen to the following factors? | Look at the following factors |
| energy | low |
| wavelength | long |
| frequency | low |
| attenuation | high |
| beam quality | low |
| B&W or Gray | B&W |
| Image contrast | high |
| scale contrast | short scale |

# Medical Terminology 7-12

| Medical Terminology | Meanings |
|---|---|
| helio- | light |
| astr- | star |
| -asthenia | weakness |
| iso- | equal |
| tarso- | ankle region |
| -tope | place |
| pod- | foot |
| malign- | bac, harmful |
| adnexa- | ties, connections |
| ocul- | eye |
| lapar- | abdominal wall |
| dacry- | tear |
| ment- | mind |
| part- | bring forth, labor |
| scle(a)- | hard |
| somato- | body |
| trachel- | neck or neckline structure |
| sinus | hollow space |
| hypno- | sleep |
| sept- | fence, wall |
| scirr(h)- | hard |
| antr- | cavity or chamber |
| -crine | to secrete |
| dura- | hard |
| pneum- | lung,air |
| phage- | eat |
| phren- | mind |
| corne- | horn like |
| plak- | plate |
| iris | rainbow |
| kerat- | horny |
| pulmon- | lung |
| ptyal- | saliva |
| alveoli- | cavity or socket |
| oophor- | ovary |
| oment- | covering of internal organs |
| sedat- | quiet, calm |
| furca- | fork shaped |
| radic- | root |
| radi- | ray |
| fistul- | pipe, or narrow passageway |

| | |
|---|---|
| edema- | swelling (fluid) |
| dactyl- | finger, toe |
| metabol(e) | change |
| pariet- | wall |
| ependym- | wrapping or cover |
| gravid | pregnancy |
| aer- | air |
| glycol- | sweet,sugar |
| gluco- | sweet, sugar |
| tarso- | framework of the upper eyelid |
| cheir | hand |
| chir- | hand |
| calc- | stone, heel |
| cine- | movement |
| digit | finger , toe |
| dors- | back |
| gangli- | knotlike mass, swelling |
| gemin- | twin or double |
| grad- | walk, take steps |
| gran- | grain, or particle |
| labi- | lip |
| micr- | small |
| peps- | digest |
| pept- | digest |
| pleur- | pleura |
| mamm- | breast |
| colla- | glue |
| later- | side |
| rachi- | spinal column |
| phob- | fear |
| phot- | light |
| dys- | bad, out of order |
| cut- | skin |
| en- | in |
| peri- | around |
| pro- | before |
| mechano- | machine |
| dynamo- | power |
| osmo- | odor |
| traumat- | injury |
| trich- | hair |
| maxilla | upper jaw bone |
| an-, a- | without, not |
| phak- | lens |
| pre- | before |
| strict- | tighten, narrow |
| | |

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|---|---|
| turbin- | shaped like a top |
| ameb- | change |
| semi- | half |
| neo- | new |
| hormone- | excite or set in motion |
| therm- | heat |
| syn- | together |
| sym- | together |
| vuls(e) | twitch or pull |
| post | after |
| metr- | uterus |
| tegument | covering or skin |
| pan- | all |
| poly- | many |
| ramus | branch |
| neuro- | nerve |
| thromb- | clot |
| ab- | away |
| -plegia | paralysis |
| ante- | before |
| thel- | nipple |
| ex- | out, away from |
| lien- | spleen |
| tumor | swelling |
| vestibule | entrance |
| puer- | child |
| sarc- | flesh |
| prolix- | offspring |
| macro- | large |
| lal- | language |
| intra- | within |
| inter- | between |
| cryo- | cold |
| mal- | bad |
| glom- | ball |
| tens- | stretch |
| spas- | pull.draw |
| somni- | sleep |
| pharmacy- | drug |
| lumbo- | loins |
| arter- | artery |
| appendic- | appendix |
| thyro- | thyroid |
| splen- | spleen |
| ovario- | ovary |
| adreno- | adrenal gland |
| | |

| | |
|---|---|
| basi- | base |
| pelvis | pelvis |
| vena- | vein |
| urethra | urethra |
| utero- | uterus |
| sacro- | sacrum |
| pharyng- | pharynx |
| duodeno- | duodenum |
| ureter | ureter |
| laryng- | larynx |
| bronch- | bronchus |
| col- | colon |
| esophag- | esophagus |
| bi- | two,double,both |
| tri- | htree |
| ile- | ileum |
| ili- | ilium |
| lig- | ligament |
| thrap- | therapy |

# Pharmacology Definitions

| Question | Answer |
|---|---|
| Ampule | small sealed glass container that holds a single dose of parenteral solution in a sterile condition |
| Analgesic | drug that relieves pain without causing a loss of consciousness |
| Anaphylaxis | condition of shock caused by hypersensitivity to a drug or other substance that results in life-threatening respiratory distress and vascular collapse |
| Anesthetic | drug that produces a loss of feeling or sensation |
| Angina Pectoris | severe constricting pain in the chest, often radiating to the shoulder and down the arm, caused by ischemia (obstruction of blood supply) of the heart muscle usually caused by coronary disease |
| Anticholinergic | drug that blocks the passage of impulses through the parasympathetic nerves |
| Arrhythmia | any variation from the normal rhythm of the heartbeat |
| Atherosclerosis | condition in which thickening of the wall of a blood vessel occurs caused by the deposit of plaque (atheroma) |
| Bolus | concentrated mass of pharmaceutical preparation |
| Bronchodilator | drug that causes expansion of the lumina of the air passages of the lungs |
| Coagulation | process of clot formation |
| Contraindication | any condition that renders the administration of some drug or some particular line of treatment improper or undesirable |
| Diabetes Mellitus | primarily a disorder of carbohydrate, protein, and fat metabolism secondary to insufficient secretion of insulin or insulin resistance |
| Diabetic Gastroparesis | form of nerve damage that affects the stomach; food does not move through the stomach in a normal way, resulting in vomiting, nausea, or bloating |
| Diuretic | drug that promotes the excretion of urine |
| Drug | any substance that, when taken into a living organism, may modify one or more of its functions |
| Edema | presence of abnormally large amounts of fluid in the tissues of the body |
| Extravasation | discharge or escape of fluid from a vessel into the surrounding tissue that can cause localized vasoconstriction, resulting in sloughing of tissue and tissue necrosis if not reversed with an antidote |
| Gastroesophageal Reflux Disease (GERD) | inflammation of the lower esophagus from regurgitation of acid gastric contents; symptoms include heartburn |
| Generic Name | drug name that is usually descriptive of its chemical structure but is not protected as is a trademark |
| Hematoma | localized collection of blood in the tissue wall resulting from a break in the wall of the blood vessel |
| Hyperlipidemia | elevations of plasma lipid concentration |
| Hypertension | persistently high arterial blood pressure, usually exceeding 140 mm Hg systolic and 90 mm Hg diastolic |
| Idiosyncratic Reaction | unusual response to a drug that is peculiar to the individual |
| Infiltration | diffusion of fluid into a tissue; often used interchangeably with extravasation |
| Intramuscular | within the muscle tissue |
| Intravenous | within a vein |
| | |

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|---|---|
| Laxative | agent that promotes evacuation of the bowel |
| Metabolic Acidosis | condition resulting from accumulation of acid or depletion of alkaline reserves (bicarbonate in the blood and body tissues) |
| Microorganism | microscopic organism such as a bacterium or a virus that is too small to be seen without a microscope |
| Opioid | any drug, natural or synthetic, that has activity similar to those of morphine |
| Parenteral | not through the gastrointestinal tract but by injection through some other route |
| Peristalsis | waves of contraction that propel contents through the gastrointestinal tract |
| Pharmacokinetics | study of the metabolism and action of drugs with particular emphasis on the time required for absorption, duration of action, distribution in the body, and method of excretion |
| Pharmacist | person who is licensed to prepare and dispense drugs |
| Pharmacology | study of drugs and their origin, nature, properties, and effects on living organisms |
| Physical Dependence | state of adaptation exhibited by a withdrawal syndrome specific to a class of drugs and that may be produced by abrupt cessation, rapid dose reduction, or adminstration of an antagonist |
| Schizophrenia | chronic mental disorder characterized by periods of withdrawn or bizarre behavior |
| Shock | condition characterized by profound hypotension and reduced tissue perfusion |
| Side Effect | consequence other than the one for which a drug is used |
| Subcutaneous | beneath the skin |
| Sublingual | beneath the tongue |
| Therapeutic | pertaining to the art of healing |
| Thromboembolic Disorders | conditions involving the partial or complete obstruction of a blood vessel |
| Tolerance | state of adaptation in response to drug exposure that results in a decrease of one or more of the drug's effects over time |
| Topical | applied to a certain area of the skin and affecting only the area to which it is applied |
| Transdermal | entering through the skin |
| Vasoconstrictor | drug that causes constriction of the blood vessels |
| Vasodilator | drug that causes dilatation of the blood vessels |
| Venipuncture | puncture of a vein |
| Vial | small glass bottle containing multiple doses of a drug |

# Radiology Terminology

| Root | Meaning |
|---|---|
| cine- | movement |
| echo- | reflected sound |
| fluor/o | luminous |
| gram | record |
| graphy | process of recording |
| ion/o | ion, to wander |
| is/o | same, equal |
| lucent | to shine |
| myel/o | spinal cord, bone marrow |
| opaque | obscure |
| pharmaceut/o | drug |
| radi/o | x-rays, radioactivity, radius (lateral lower arm bone) |
| roentgen/o | x-rays |
| scint/i | spark |
| son/o | sound |
| therapeut/o | treatment |
| tom/o | to cut |
| ultra- | beyond, excess |
| vitr/o | vitreous body (of the eye) |
| viv/o | life |

# Radiology Terminology

| Rad Terminology | Answers |
|---|---|
| Abduction | Away from body |
| Inversion | Hand or foot turned inward |
| Midsagittal | Dives body into equal right and left sections |
| Midcoronal | Divides body into anterior and posterior sections |
| Transverse | Cross-sectional slices of the body |
| Radiograph | Images illustrated on x-ray film |
| Projection | Path of beam |
| Anatomical Position | Patient standing with palms up, head straight, arms at the side |
| Supine | Lying on back |
| Prone | Lying on front |
| Recumbent | General term for lying down |
| Trendelenburg | Head lower than feet |
| Dorsal | Back |
| Ventral | Front |
| PA | Central ray path from posterior to anterior |
| AP | Central ray from anterior to posterior |
| Lateral | Patient on side |
| Oblique | Part angled sometimes 45 degrees |
| Decubitus | Horizontal beam |
| Caudal | Tube angled toward feet |
| Cephalic | Toward head |
| Pronate | To turn arm so that palm of hand faces down |
| Projection (Central Ray) | Describes path of radiation as it goes from x-ray tube through patient to film. |
| Decubitus projection | Patient is lying down and CR is parallel to horizon |
| Left Posterior Oblique | Patient is lying face up with right side up and left side down. |
| Proximal | Near the source |
| Inferior | Below |
| Superior | Above |
| Distal | Farthest from the source |
| Flexion | Bending of part |
| Extension | Straightening of part |
| Right Anterior Oblique | Patient's right anterior surface touching cassette at a 45-degree angle. |
| Medial | Refers to parts toward the midline or middle of a part. |
| Deep | Farther from the skin surface |
| Contralateral | On the opposite side |
| Ipsilateral | On the same side |
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|---|---|
| Superficial | Near the skin surface |
| Cephalad | Toward the head end of the body |
| Caudad | Away from the head end |
| Plantar | Sole of the foot |
| Dorsum | Top or anterior surface of the foot or posterior surface of hand |
| Circumduction | Circular movement of limb away from body |
| Rotation | Turning or rotating of body/body part around its axis |
| Tilt | Tipping or slanting a body part slightly |
| Fowler's Position | Head higher than feet |
| Lithotomy Position | Supine position with knees and hip flexed and thighs abducted and rotated externally, supported by ankle supports (Pap Smear) |
| Sim's Position | Recumbent position with patient lying on left anterior side with left leg extended and right knee/thigh partially flexed |
| Dorsal Recumbent | Lying on back |
| Ventral Recumbent | Lying face down |
| Decubitus Position | Patient lying down, CR is horizontal and parallel with floor |
| Lordotic Position | Patient leans backward in upright position, with only shoulder in contact with IR |
| Lateral Projection | Perpendicular CR enters either side of body/part, passes traversely along coronal plane, and exits opposite side |
| Tangential Projection | CR directed toward outer margin of a curved body surface to profile body part just under surface |
| True Position | Specifically indicates that body part must be placed exactly in anatomic position |
| Axial Projection | Longitudinal angulation of CR with long axis of body or body part, 10 degrees or more |

# Surface landmarks used in radiology

| Question | Answer |
|---|---|
| C1 | MASTOID TIP |
| C2 - C3 | GONION |
| C3 - C4 | HYOID |
| C5 | THYROID |
| C7 | VERTEBRA PROMINENS |
| T1 | APPROXIMATELY 2" ABOVE JUGULAR NOTCH |
| T2 - T3 | JUGULAR NOTCH |
| T4 - T5 | STERNAL ANGLE |
| T7 | INFERIOR ANGLES OF SCAPULA |
| T9 - T10 | XIPHOID PROCESS |
| L2 - L3 | LUMBAR PUNCTURE |
| L4 - L5 | ILIAC CREST |
| S1 - S2 | ASIS |
| PUBIC SYMPHYSIS/GREATER TROCHANTERS | COCCYX |